SEPTEMBER HIGHLIGHT

Hurricane Hermine's Dual Personality

by Jeffrey B. Halverson

On September 1, 2016, a Category 1 hurricane named Hermine struck the Big Bend region of Florida. Hermine moved northeast across Florida, then along the coastal plain of Georgia and the Carolinas. On September 3, the storm moved back over the Atlantic, along the North Carolina Outer Banks. The storm that emerged off the southeast coast was very different in physical appearance. On September 1, the cloud system was symmetric and pinwheel-shaped. On September 3, Hermine was highly asymmetric, with most of the dense cloud and heavy rain lopped north-northeast of center. In fact, it possessed a "comma shape" very similar to that of a winter-season cyclone called the nor'easter that commonly develops over the Outer Banks.

What happened to Hermine? Between September 1 and 3, the system underwent a metamorphosis. It lost some of its tropical identity in exchange for properties of an extratropical cyclone. This type of storm, on a spectrum, exists in a kind of "hybrid" space where cloud, wind, and precipitation characteristics overlap between the purely tropical and the purely extratropical. The metamorphosis plays out according to a set of meteorological rules termed "extratropical transition." Hermine is not the first storm to do this; Sandy did it in 2012, as have a host of other cyclones going back to Hazel in 1954 (and many others long before). Essentially, a tropical vortex begins to weaken as it encounters cooler, mid-latitude waters (or moves over land); its winds experience increasing deflection due to the earth's spin (called the Coriolis effect); and the jet stream, powered by the mid-latitude's strong temperature contrasts, begins to dominate the storm's behavior.

To see how Hermine underwent such drastic changes in less than 48 hours, let's examine Figure 1. It shows the evolution of the storm's surface characteristics at three different times. On September 1, Hermine was intensifying to Category 1 strength over the Gulf of Mexico—a full blown tropical cyclone. On September 2, Hermine moved inland and weakened to a tropical storm over Georgia. Heavy rain bands, initially confined to the storm's core, began to overspread the Carolina coast, hundreds of miles to the northeast of the storm's center. They developed when Hermine's moist, onshore flow began overrunning a cold front that sagged southeastward. The interaction between a purely tropical vortex with a mid-latitude front marked the onset of

Hermine's extratropical transition.

By September 3, a cool, dry air mass began to wrap around the remnant vortex of Hermine, creating a cold front that surged offshore. At this stage, the storm looked uncannily like a nor'easter. However, it was not a "true" nor'easter, in the sense that these storms initiate off Cape Hatteras, beneath the jet stream, only during winter. A very cold air mass must slide eastward, parking next to mild Atlantic waters and setting up a pronounced temperature gradient (coastal front). The temperature gradient is the primary energy source for the strengthening nor'easter. Neither an intense temperature gradient, nor jet stream processes, factored into the extratropical transition of Hermine.

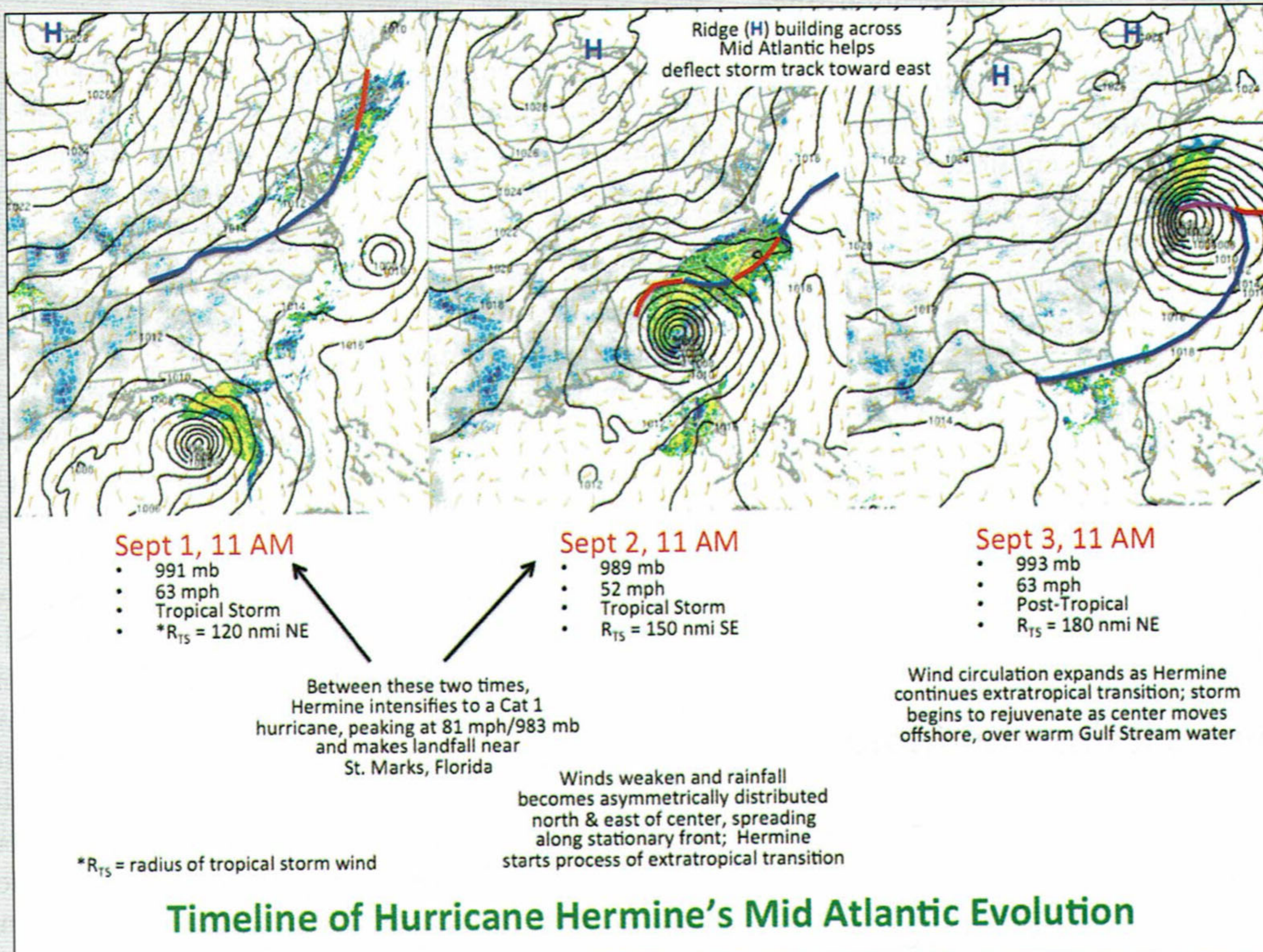

Figure 1.

Weatherwise Contributing Editor JEFFREY B. HALVERSON *is Professor of Geography at the University of Maryland, Baltimore County.*